PB-239 704

EMBARRASS LAKE, ST. LOUIS COUNTY, MINNESOTA

Pacific Northwest Environmental Research Laboratory

Prepared for:

Minnesota Pollution Control Agency
Minnesota National Guard
National Environmental Research Center

December 1974

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE

3/6

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO.	2.	3. PB 239 704
4. TITLE AND SUBTITLE: Report on Embarrass Lake, St. Louis County, Minnesota		5. REPORT DATE: Prepared December 1974
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S): Anonymous (National Eutrophication Survey Staff)		8. PERFORMING ORGANIZATION REPORT NO.: Working Paper # 98
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Pacific Northwest Environmental Research Laboratory U.S.Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97330		10. PROGRAM ELEMENT NO.: 1BA029 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS: U.S. Environmental Protection Agency		13. TYPE OF REPORT AND PERIOD COVERED: Final - 1972 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES: Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report)	21. NO. OF PAGES
Release unlimited		31
	20. SECURITY CLASS (This page)	22. PRICE 3.75

EPA Form 2220-1 (9-73)

REPORT
ON
EMBARRASS LAKE
ST. LOUIS COUNTY
MINNESOTA
EPA REGION V
WORKING PAPER No. 98

WITH THE COOPERATION OF THE
MINNESOTA POLLUTION CONTROL AGENCY
AND THE
MINNESOTA NATIONAL GUARD

DECEMBER, 1974

CONTENTS

	Page
Foreword	ii
List of Minnesota Study Lakes	iv, v
Lake and Drainage Area Map	vi
Sections	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	3
III. Lake Water Quality Summary	4
IV. Nutrient Loadings	8
V. Literature Reviewed	13
VI. Appendices	14

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Minnesota Pollution Control Agency for professional involvement and to the Minnesota National Guard for conducting the tributary sampling phase of the Survey.

Grant J. Merritt, Director of the Minnesota Pollution Control Agency, John F. McGuire, Chief, and Joel G. Schilling, Biologist, of the Section of Surface and Groundwater, Division of Water Quality, provided invaluable lake documentation and counsel during the course of the Survey; and the staff of the Section of Municipal Works, Division of Water Quality, were most helpful in identifying point sources and soliciting municipal participation in the Survey.

Major General Chester J. Moeglein, the Adjutant General of Minnesota, and Project Officer Major Adrian Beltrand, who directed the volunteer efforts of the Minnesota National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

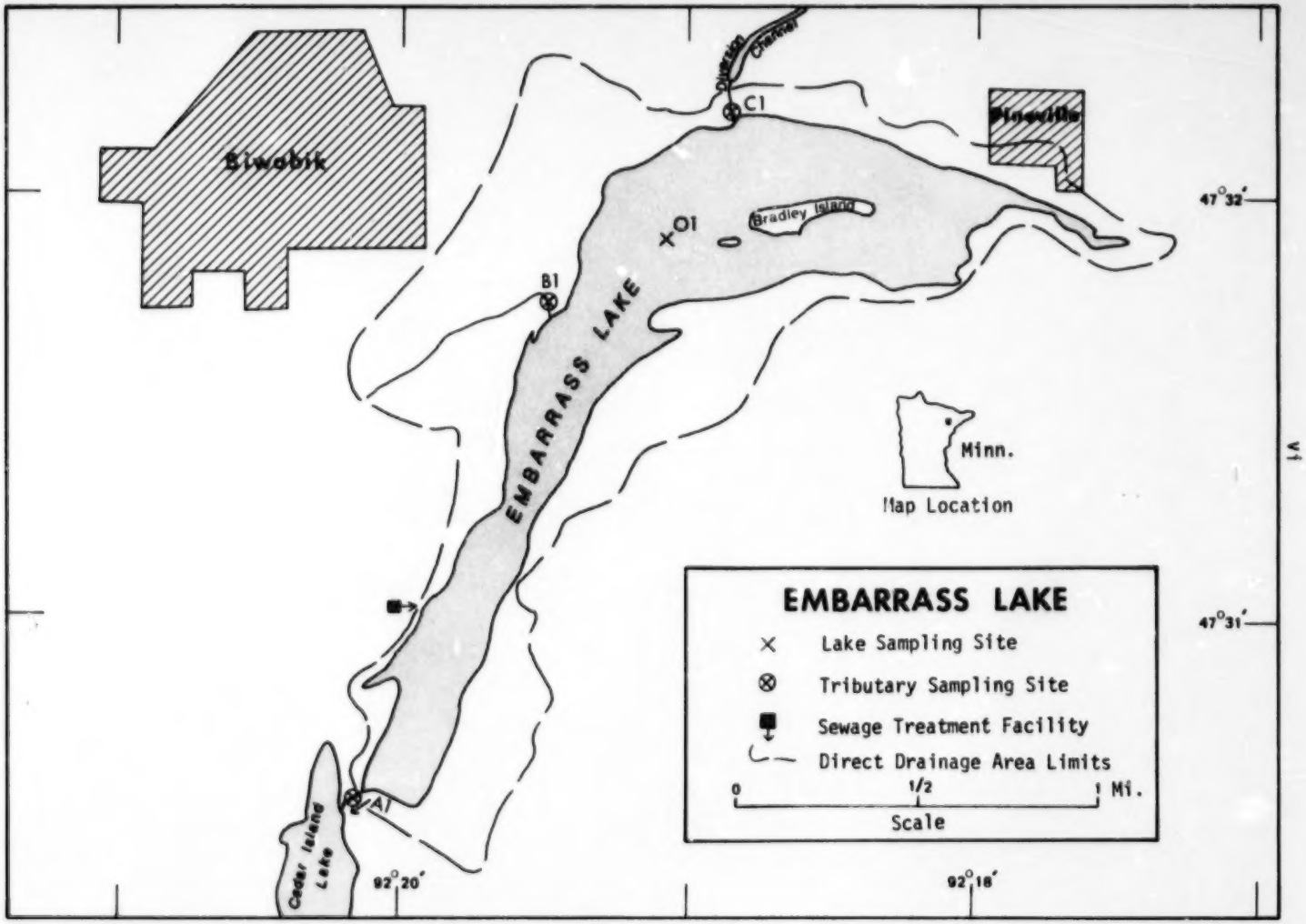
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF MINNESOTA

LAKE NAME	COUNTY
Albert Lea	Freeborn
Andrusia	Beltrami
Badger	Polk
Bartlett	Koochiching
Bear	Freeborn
Bemidji	Beltrami
Big	Stearns
Big Stone	Big Stone, MN; Roberts, Grant, SD
Birch	Cass
Blackduck	Beltrami
Blackhoof	Crow Wing
Budd	Martin
Buffalo	Wright
Calhoun	Hennepin
Carlos	Douglas
Carrigan	Wright
Cass	Beltrami, Cass
Clearwater	Wright, Stearns
Cokato	Wright
Cranberry	Crow Wing
Darling	Douglas
Elbow	St. Louis
Embarass	St. Louis
Fall	Lake
Forest	Washington
Green	Kandiyohi
Gull	Cass
Heron	Jackson
Leech	Cass
Le Homme Dieu	Douglas
Lily	Blue Earth
Little	Grant
Lost	St. Louis

LAKE NAME	COUNTY
Madison	Blue Earth
Malmedal	Pope
Mashkenode	St. Louis
McQuade	St. Louis
Minnetonka	Hennepin
Minnewaska	Pope
Mud	Itasca
Nest	Kandiyohi
Pelican	St. Louis
Pepin	Goodhue, Wabasha, MN; Pierce, Pepin, WI
Rabbit	Crow Wing
Sakatah	Le Sueur
Shagawa	St. Louis
Silver	McLeod
Six Mile	St. Louis
Spring	Washington, Dakota
St. Croix	Washington, MN; St. Croix, Pierce, WI
St. Louis Bay	St. Louis, MN; Douglas, WI
Superior Bay	St. Louis, MN; Douglas, WI
Swan	Itasca
Trace	Todd
Trout	Itasca
Wagonga	Kandiyohi
Wallmark	Chisago
White Bear	Washington
Winona	Douglas
Wolf	Beltrami, Hubbard
Woodcock	Kandiyohi
Zumbro	Olmstead, Wabasha


Biwabik
Diversion Channel
C1
Bradley Island
O1
B1
EMBARRASS LAKE
Minn.
Map Location
EMBARRASS LAKE
Lake Sampling Site
Tributary Sampling Site
Sewage Treatment Facility
Direct Drainage Area Limits
0
1/2
1 Mi.
Scale
A1
Cedar Island Lake
47°32'
47°31'
92°20'
92°18'

EMBARRASS LAKE

STORET NO. 2728

I. CONCLUSIONS

A. Trophic Condition:

Survey data show that Embarrass Lake is eutrophic. Of the 60 Minnesota lakes sampled in the fall of 1972, 20 had less mean total phosphorus, 24 had less mean dissolved phosphorus, and 32 had less mean inorganic nitrogen. Of the 80 Minnesota lakes sampled, six had less mean chlorophyll a, and 41 had greater Secchi disc transparency.

B. Rate-Limiting Nutrient:

The algal assay sample was lost in shipment; however, the lake data indicate nitrogen limitation in July and October and phosphorus limitation in September.

C. Nutrient Controllability:

1. Point sources--It is estimated that about 48% of the mean annual phosphorus load reaching Embarrass Lake during the sampling year was contributed by the Biwabik wastewater treatment plant and the septic tanks of the community of Pineville.

The present loading rate of 15.2 lbs/acre/yr or 1.70 $g/m^2/yr$ is in excess of the "dangerous rate" (i.e., a eutrophic rate) as proposed by Vollenweider (in press; see page 12). However, 80% phosphorus removal at Biwabik would reduce the loading rate to

9.3 lbs/acre/yr or 1.04 $g/m^2/yr$ (a mesotrophic rate) and should result in improvement of the trophic condition of Embarrass Lake.

2. Non-point sources (see page 12)--The phosphorus exports of the Embarrass Lake tributaries were quite low during the sampling year and were similar to the exports of unimpacted streams studied elsewhere in St. Louis County.

In all, it is estimated that non-point sources contributed about 51% of the total phosphorus load to the lake during the sampling year.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 507 acres.
2. Mean depth: 8.6 feet.
3. Maximum depth: 18 feet.
4. Volume: 4,360 acre/feet.
5. Mean hydraulic retention time: 22 days.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area*	Mean flow*
Diversion Channel	142.0 mi^2	94.0 cfs
Unnamed Stream (B-1)	2.4 mi^2	1.4 cfs
Minor tributaries & immediate drainage -	5.2 mi^2	3.5 cfs
Totals	149.6 mi^2	98.9 cfs

2. Outlet -

Embarrass Lake outlet	150.4 mi^2**	98.9 cfs

C. Precipitation***:

1. Year of sampling: 28.0 inches.
2. Mean annual: 27.0 inches.

---

† DNR lake survey map (1964); mean depth by random-dot method.
* Drainage areas are accurate within ±5%; mean daily flows are accurate within ±10%; and ungaged flows are accurate within ±10 to 25% for drainage areas greater than 10 mi^2.
** Includes area of lake.
*** See Working Paper No. 1, "Survey Methods".

III. LAKE WATER QUALITY SUMMARY

Embarrass Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two or more depths at a single station on the lake (see map, page vi). During each visit, a single depth-integrated (near bottom to surface) sample was collected for phytoplankton identification and enumeration, and a similar sample was collected for chlorophyll a analysis. During the last visit, a sample was taken for algal assays but subsequently lost in shipment. The maximum depth sampled was 9 feet.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake essentially was well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (10/19/72)		
Temperature (Cent.)	4.4	4.4	4.4	4.4
Dissolved oxygen (mg/l)	11.0	12.0	12.0	13.0
Conductivity (µmhos)	130	136	138	140
pH (units)	7.4	7.4	7.4	7.5
Alkalinity (mg/l)	23	23	23	23
Total P (mg/l)	0.029	0.036	0.037	0.042
Dissolved P (mg/l)	0.017	0.023	0.022	0.029
NO_2 + NO_3 (mg/l)	0.160	0.160	0.160	0.160
Ammonia (mg/l)	0.060	0.063	0.060	0.070
		ALL VALUES		
Secchi disc (inches)	24	39	46	48

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
07/08/72	1. Tabellaria	3,263
	2. Asterionella	967
	3. Flagellates	544
	4. Elakatothrix	362
	5. Dinobryon	242
	Other genera	665
	Total	6,043
09/09/72	1. Dinobryon	398
	2. Melosira	133
	3. Phacus	108
	4. Cyclotella	72
	5. Fragilaria	66
	Other genera	495
	Total	1,272
10/19/72	1. Flagellates	2,462
	2. Dinobryon	1,131
	3. Cryptomonas	427
	4. Melosira	402
	5. Achnanthes	251
	Other genera	930
	Total	5,603

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
07/08/72	01	6.9
09/09/72	01	1.9
10/19/72	01	6.0

C. Limiting Nutrient Study:

The algal assay sample was lost in shipment. However, the lake data indicate nitrogen limitation in July (N/P ratio = 5/1) and October (N/P = 10/1) but phosphorus limitation in September (N/P = 17/1).

IV. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the Minnesota National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vi), except for the months of December, April, and May when two samples were collected. Sampling was begun in October, 1972, and was completed in September, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Minnesota District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated by using the nutrient loads, in lbs/mi^2/year, at station B-1 and multiplying by the ZZ area in mi^2.

The City of Biwabik did not participate in the Survey and nutrient loads were estimated at 2.5 lbs P and 7.5 lbs N/capita/year.

---

* See Working Paper No. 1.

A. Waste Sources:

1. Known municipal* -

Name	Pop. Served	Treatment	Mean Flow (mgd)	Receiving Water
Biwabik	1,483	stab. ponds	0.148**	Embarrass Lake

2. Known industrial - None

* Anonymous, 1974.
** Estimated at 100 gal/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Diversion Channel	3,530	45.9
Unnamed Stream (B-1)	110	1.4
b. Minor tributaries & immediate drainage (non-point load) -	240	3.1
c. Known municipal STP's -		
Biwabik	3,710	48.3
d. Septic tanks* -	20	0.3
e. Known industrial - None	-	-
f. Direct precipitation** -	80	1.0
Total	7,690	100.0

2. Outputs -

Lake outlet - Embarrass Lake/ Cedar Island Lake Connection	7,910

3. Net annual P loss - 220 pounds

* Estimate based on 22 dwellings in Pineville at 4 persons each; see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Diversion Channel	213,880	89.9
Unnamed Stream (B-1)	2,280	1.0
b. Minor tributaries & immediate drainage (non-point load) -	4,940	2.0
c. Known municipal STP's -		
Biwabik	11,120	4.7
d. Septic tanks* -	830	0.3
e. Known industrial - None	-	-
f. Direct precipitation** -	4,880	2.1
Total	237,930	100.0

2. Outputs -

Lake outlet - Embarrass Lake/ Cedar Island Lake Connection	181,240

3. Net annual N accumulation - 56,690 pounds

* Estimate based on 22 dwellings in Pineville at 4 persons each; see Working Paper No. 1.

** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs $P/mi^2/yr$	lbs $N/mi^2/yr$
Diversion Channel	25	1,506
Unnamed Stream (B-1)	46	950

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	15.2	loss*	469.3	111.8
grams/m^2/yr	1.70	-	52.6	12.5

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydraulic retention time for Embarrass Lake:

"Dangerous" (eutrophic rate)	1.26
"Permissible" (oligotrophic rate)	0.63

* There was an apparent phosphorus loss during the sampling year. This probably was due to an underestimation of the loads from Biwabik and/or Pineville or an unknown and unsampled point source discharging directly to the lake.

V. LITERATURE REVIEWED

Anonymous, 1974. Wastewater disposal facilities inventory. MPCA, Minneapolis.

Schilling, Joel, 1974. Personal communication (lake map). MPCA, Minneapolis.

Vollenweider, Richard A., (in press). Input-output models. Schweiz A. Hydrol.

VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR MINNESOTA 10/30/74

LAKE CODE 2729 SWAMPASS LAKE

TOTAL DRAINAGE AREA OF LAKE 150.40

TRIBUTARY	SUB-DRAINAGE AREA	JAN	FEB	MAR	APR	MAY	NORMALIZED FLOWS JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
272RA1	150.40	22.13	17.50	31.22	215.40	248.70	149.50	114.50	63.40	59.60	90.20	50.90	40.10	98.96
272RR1	3.44	0.14	0.11	0.38	2.83	4.27	3.15	1.77	0.75	1.59	1.14	0.52	0.46	1.43
272RC1	142.00	20.40	16.20	24.00	149.00	268.00	176.00	107.00	58.40	81.20	83.90	47.20	37.40	93.98
272R77	5.36	0.74	0.45	1.12	7.01	10.20	7.45	4.14	1.80	3.59	2.72	1.28	1.41	3.54

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 150.40
SUM OF SUB-DRAINAGE AREAS = 150.40

TOTAL FLOW IN = 1183.88
TOTAL FLOW OUT = 1183.50

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
272RA1	10	72	42.73	15	43.00				
	11	72	35.18	6	34.53				
	12	72	7.62	2	12.00	26	8.10		
	1	73	8.53						
	2	73	8.54						
	3	73	15.13	3	7.13				
	4	73	62.98	7	34.00	21	210.00		
	5	73	238.08	5	112.00	29	117.00		
	6	73	134.01	24	140.01				
	7	73	63.38	4	37.00				
	8	73	191.00	22	126.00				
	9	73	44.59	6	50.00				
272R41	10	72	6.55	15	6.50				
	11	72	6.26	6	0.40				
	12	72	0.09	2	0.10	26	0.10		
	1	73	0.07						
	2	73	0.01	3	0.01				
	3	73	0.46	3	1.72				
	4	73	0.91	7	0.59	21	2.80		
	5	73	3.81	5	1.70	29	2.70		
	6	73	2.12	24	2.00				
	7	73	0.54	4	0.60				
	8	73	1.21	22	1.50				
	9	73	0.69	6	0.90				

TRIBUTARY FLOW INFORMATION FOR MINNESOTA 10/30/74

LAKE CODE 2724 [illegible] LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
272AC1	10	72	40.36	15	40.00				
	11	72	23.68	6	37.00				
	12	72	7.11	2	7.70	26	7.10		
	1	73	[illegible]						
	2	73	[illegible]	1	1.10				
	3	73	70.[illegible]	3	125.00				
	4	73	64.50	7	32.00	21	197.00		
	5	73	220.[illegible]	5	105.00	29	169.00		
	6	73	119.00	24	111.00				
	7	73	41.[illegible]	8	35.00				
	8	73	36.[illegible]	22	114.00				
	9	73	42.20	4	48.00				
272A77	10	72	1.31	15	1.30				
	11	72	1.44	6	1.00				
	12	72	0.27	2	0.30	26	0.30		
	1	73	0.26						
	2	73	0.[illegible]	1	0.40				
	3	73	3.21	3	5.70				
	4	73	2.27	7	1.10	21	6.40		
	5	73	4.36	5	4.00	29	6.40		
	6	73	5.14	24	4.20				
	7	73	1.60	6	1.40				
	8	73	3.43	22	3.50				
	9	73	1.28	9	2.10				

Reproduced from best available copy.

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/10/30

272801
47 31 52.0 092 19 08.0
EMBARRASS LAKE
27 MINNESOTA

11EPALES
3

2111202
0008 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/07/08	15 15	0000	20.9	9.2	48	95	7.00	39	0.020	0.030	0.025	0.010
	15 15	0008	20.9	7.8		90	7.10	37	0.040	0.030	0.025	0.013
72/09/09	08 45	0000			46	135	7.28	46	J.100	0.100	0.020	0.012
	08 45	0004	15.9	7.0		130	7.15	51	0.100	0.100	0.021	0.013
72/10/19	16 00	0000			24	130	7.40	23	0.160	0.060	0.037	0.022
	16 00	0004	4.4	13.0		140	7.50	23	0.160	0.060	0.042	0.029
	16 00	0009	4.4	11.0		139	7.40	23	0.160	0.070	0.029	0.017

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/07/08	15 15	0000	6.4J
72/09/09	08 45	0000	1.4J
72/10/19	16 00	0000	6.0J

J VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/10/30

2728A1 LS2728A1
47 30 30.0 092 20 00.0
EMBARASS LK/CEDAR ISLAND LK CONN
27 1.5 AIWABIK
O/EMBARASS LAKE
CO HWY 4 NROG 1.5 MI S OF AIWABIK
11EPALES 2111204
0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO3&NO2 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/15	16 10		0.182	0.975	0.105	0.096	0.138
72/11/06	11 25		0.200	0.450	0.005K	0.009	0.031
72/12/02	10 50		0.231	0.675	0.025	0.008	0.027
72/12/26	15 20		0.273	0.450	0.022	0.013	0.028
73/03/04	10 30		0.340	0.450	0.024	0.014	0.025
73/04/07	10 00		0.189	0.690	0.036	0.007	0.025
73/04/21	19 40		0.095	0.900	0.037	0.024	0.105
73/05/05	17 10		0.189	0.960	0.039	0.010	0.030
73/05/24	21 10		0.150	0.730	0.014	0.013	0.025
73/06/24	19 20		0.066	0.650	0.015	0.005K	0.020
73/07/28	16 30		0.050	0.790	0.040	0.007	0.025
73/08/22	16 40		0.034	0.660	0.039	0.011	0.020
73/09/24	11 10		0.024	0.390	0.060	0.040	0.045

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/10/30

2728B1 LS2728B1
47 32 00.0 092 19 30.0
UNNAMED TRIB TO W SIDE OF LAKE
27 7.5 AIWABIK
T/EMBARASS LAKE
XING .5 MI ESE OF AIWABIK
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/15	15 50		0.075	0.525	0.115	0.007	0.024
72/11/06	11 15		0.130	0.620	0.005K	0.015	0.056
72/12/02	10 35		0.044	0.440	0.091	0.013	0.025
72/12/26	16 05		0.073	1.830	0.210	0.030	
73/02/03	10 05		0.024	1.100	0.340	0.054	0.080
73/03/03	10 15		0.310	1.260	0.440	0.050	0.150
73/04/07	09 45		0.025	0.460	0.007	0.007	0.025
73/04/21	19 50		0.170	0.730	0.021	0.006	0.025
73/05/05	16 50		0.044	0.660	0.032	0.012	0.050
73/05/29	20 45		0.010K	0.840	0.020	0.010	0.015
73/06/24	09 55		0.017	0.500	0.015	0.007	0.015
73/07/08	10 00		0.034	0.630	0.050	0.022	0.030
73/08/22	16 10		0.013	0.660	0.035	0.014	0.035
73/09/04	10 35		0.015	0.920	0.028	0.018	0.040

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 74/10/30

Reproduced from best available copy.

2728C1 LS2728C1
47 32 30.0 092 19 00.0
DIVERSION CHANNEL #ANE LK/EMBARA
27 7.5 HIWABIK
1/EMBARASS LAKE
CO HWY 135 XING BETWEEN HIWABIK-PINEVILL
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/15			0.270	0.875	0.083	0.006	0.027
72/11/06	11 01		0.256	1.400	0.005K	0.011	0.027
72/12/02	10 20		0.252	0.845	0.010	0.009	0.027
72/12/26	15 40		0.370	0.780	0.026	0.011	0.030
73/02/07	10 20		0.370	1.320	0.052	0.014	0.025
73/03/03	10 00		0.378	1.765	0.070	0.008	0.020
73/04/07	09 30		0.252	0.630	0.018	0.006	0.020
73/04/21	13 25		0.250	0.710	0.033	0.005K	0.020
73/05/29	20 35		0.105	1.470	0.054	0.007	0.020
73/06/24	09 40		0.065	0.690	0.035	0.005K	0.007
73/07/08	09 30		0.120	0.910	0.043	0.005K	0.015
73/08/22	15 45		0.150	0.750	0.040	0.018	0.020
73/09/04	10 15		0.115	1.260	0.042	0.007	0.030

K VALUE KNOWN TO BE LESS THAN INDICATED